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Information technology — JPEG XL image coding system —

Part 4: Reference software

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Contents

Page

Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

A list of all parts in the ISO/IEC 18181 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

Information technology — JPEG XL image coding system —

Part 4:
Reference software

1 Scope

This document provides reference implementations of ISO/IEC 18181-1 and ISO/IEC 18181-2. The software supports lossless and lossy compression of images and image sequences for a wide range of use cases such as (but not limited to) images with wide colour gamut and/or high dynamic range and responsive web images. This document includes source code and instructions for compilation and usage.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 18181-1, *Information technology — JPEG XL image coding system — Part 1: Core coding system*

ISO/IEC 18181-2, *Information technology — JPEG XL image coding system — Part 2: File format*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 18181-1 and ISO/IEC 18181-2 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Reference software

4.1 General

The purpose of this document is to provide the following:

— Reference decoder software capable of decoding codestreams that conform to ISO/IEC 18181-1 and files that conform to ISO/IEC 18181-2.

— Reference encoder software capable of producing codestreams that conform to ISO/IEC 18181-1 and files that conform to ISO/IEC 18181-2.

The use of the reference software is not required for making an implementation of an encoder or decoder in conformance to ISO/IEC 18181-1 or ISO/IEC 18181-2. Requirements established in ISO/IEC 18181-1 and ISO/IEC 18181-2 take precedence over the behaviour of the reference software.

4.2 Examples of use

The reference decoder software can be used for (non-exhaustive list):

— as an illustration of how to perform the decoding processes specified in ISO/IEC 18181-1 and ISO/IEC 18181-2;

— as the starting basis for the implementation of a decoder that conforms to ISO/IEC 18181-1 and ISO/IEC 18181-2;

— as a decoder implementation, integrated in an image display or image editing application that supports ISO/IEC 18181-2 as an input file format;

— for (non-exhaustive) testing of the conformance of a codestream (or file) to the constraints specified in ISO/IEC 18181-1 and ISO/IEC 18181-2.

NOTE 1 The lack of detection of any conformance violation by any reference software implementation cannot be considered as a definitive proof that the codestream under test conforms to ISO/IEC 18181-1 or that the file under test conforms to ISO/IEC 18181-2.

The reference encoder software can be used for (non-exhaustive list):

— as an illustration of how to implement an encoding process that produces codestreams that conform to ISO/IEC 18181-1 and files that conform to ISO/IEC 18181-2;

— as a starting point for an implementation of an encoder that conforms to ISO/IEC 18181-1 and ISO/IEC 18181-2;

— as an encoder implementation, integrated in an image authoring application that supports ISO/IEC 18181-2 as an export file format;

— a means of generating codestreams conforming to ISO/IEC 18181-1 for testing purposes;

— a means of generating files conforming to ISO/IEC 18181-2 for testing purposes;

— a means of demonstrating and evaluating examples of the quality that can be achieved by an encoding process that conforms to ISO/IEC 18181-1.

NOTE 2 No guarantee of the quality that will be achieved by an encoder is provided by its conformance to ISO/IEC 18181-1, as the conformance of an encoder is only defined in terms of specific constraints imposed on the syntax of the generated codestream. In particular, while sample encoder software implementations could suffice to provide some illustrative examples of which quality can be achieved within ISO/IEC 18181-1, they provide neither an assurance of minimum guaranteed image encoding quality nor maximum achievable image encoding quality.

NOTE 3 The computation resource characteristics in terms of program or data memory usage, execution speed, etc. of sample software encoder or decoder implementations cannot be construed as representative of the typical, minimal or maximal computational resource characteristics to be exhibited by implementations of some parts of ISO/IEC 18181-1.

4.3 Access

The reference software implementation for the ISO/IEC 18181 is provided as an electronic attachment to this document, available from https://standards.iso.org/iso-iec/18181/-4/ed-1/en

NOTE 1 Building and usage instructions are provided in the file called README.md which is contained in the Zip file.

4.4 Dependencies

Excluding optional dependencies for input/output formats (detailed in Clause 5), the reference software can be built for different operating systems and makes use of the following dependencies:

— highway (included in the Zip file)

— brotli (included in the Zip file)

— lcms2 or skcms (encoder only, to handle arbitrary ICC profiles in the input; skcms is included in the Zip file)

— IQA-optimization, vmaf, difftest_ng (optional, for computing metrics for evaluation with the `benchmark_xl` tool)

5 Usage instructions

This clause is informative.

Build instructions are provided in the file called README.md included in the Zip file.

To encode a source image to JPEG XL with default settings:

```
cjxl input.png output.jxl
```

For more settings:

```
cjxl --help
```

For a full list of options:

```
cjxl -v -v --help.
```

To decode a JPEG XL file:

```
djxl input.jxl output.png
```

The following input/output image formats are supported; all the dependencies listed here can be optionally disabled:

— .ppm

— .pgm

— .pfm

— .pgx

— .png: requires lodepng or libpng

— .exr: requires libopenexr

— .gif: requires giflib

— .jpeg/.jpg: requires libjpeg or sjpeg, except for lossless JPEG bitstream recompression and reconstruction as per ISO/IEC 18181-2

Additional options are documented in the README.md file.

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